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PLANT PATHOLOGY.

Diseases of Plants induced by Cryptogamic Parasites. By Dr. Karl Freiherr von Tubeuf. English Edition, by William G. Smith, B.Sc., Ph.D. Pp. xv + 598. (London: Longmans, 1897.)

WHEN the German edition of this work appeared, early in 1894, it at once took rank as one of the most comprehensive and accurate treatises on the subject that had as yet appeared, and the English edition we now have to welcome still deserves this tribute to its merits, for the author has taken the opportunity of adding considerably to the already bulky volume.

The fungus-diseases of plants now number so many forms, that no apology is necessary for treating them separately from the very numerous other diseases of plants; but it should be clearly borne in mind that only part of the very wide subject of the pathology of plants comes under this head, as may be readily seen on comparing the new edition of Frank's "Krankheiten der Pflanzen," which has appeared in the interval, and of which the first volume is devoted to the diseases due to non-living agents, the second to those caused by parasitic plants (not fungi only), and the third to pathological states induced by animals.

Thus comprehensive works on the whole range of this vast subject are not wanting, and the student should observe that the standpoint from which a treatise like this is written differs considerably from those assumed by writers on the general subject of pathology, or those who deal with the morphology and physiology of the fungi.

Berkeley, Frank, Sorauer, and Hartig have shown that the diseases of plants constitute a theme by itself which may be treated with reference either to the symptoms and progress of the pathological conditions, where the victim of disease furnishes the principal phenomena discussed, or to the causes or agents which induce these pathological conditions. These agents may be internal or external, and the latter comprise factors of the non-living environment, or living organisms—animals or plants in anti biotic relations to the host, or victim.

The present large volume, of more than 600 pages with 330 illustrations, is devoted, as said, to the narrower theme, and bears witness to the astonishing progress made in the study of the parasitic fungi during the last quarter of a century.

Its subject-matter is principally the fungi themselves, and in character it partakes of the nature of a flora or diagnostic list, and a treatise on symptoms and therapeutics, with bibliographical references for those who wish to launch further into this particular arm of the sea of knowledge. It is thus neither a complete treatise on the biology of fungi, nor a detailed work on pathology, but—and in this reside its peculiar characteristics—a volume compiled to meet the wants of an increasing class of students who wish to know something of the parasitic fungi themselves and what plants they attack; something of the mode of attack and the symptoms induced; and something of the suggestions for combating the diseases which have been supplied by experiments in the field. It is thus a typical example of a class of book evolved under the stimulus of the practical spirit of the age, and, in fairness to all be it said, of a high standard of excellence as scientific literature; further, it will be of no use to the crammer, to the examinee, or the dilettante, but must take its place on the shelf of the serious worker, the true naturalist, and the educated cultivator of plants as an indispensable work of reference.

The book consists of two parts, of which the first contains chapters on the nature of parasites and parasitism, the reactions between host and parasite, infection, predisposition, preventive measures, and the economic importance of the diseases of plants, together with a short summary of the facts of symbiosis.

The second, and far larger part, is devoted to a systematic account of cryptogamic parasites—the fungi proper, slime-fungi, bacteria and pathogenic algæ being included. The system followed is that of Brefeld, the saprophytic forms being omitted.

Objection may be made to the inclusion of the algæ and symbiotic forms, such as mycorhiza, the organisms of the leguminous nodules, lichens, &c.; but Tubeuf has something of his own to say about these matters, and although I do not agree with his strained attempts to classify the phenomena of saprophytism, parasitism, and symbiosis, and regard his selection and definition of the terms *nutricism* and *individualism* as particularly unfortunate and misleading, I think that he was quite right in discussing these matters here, if only to help in emphasising the real nature of parasitism by contrast.

The author has avoided several pitfalls. It would have been easy to give way to temptations to discuss in detail several disputed points, especially as Tubeuf is himself an investigator with strong views of his own; but it is noticeable throughout that he attempts a fair summary of the published accounts. The fault of over-description has also been wisely and ably avoided, and this, on the whole, without sacrifice of usefulness; though it must be borne in mind that a good deal of preliminary acquaintance with the subject is necessarily demanded from the reader. Again, there is sufficient treatment of theoretical matters to make the book attractive to botanists not specially concerned with pathology in detail, and, further, the hints on practical therapeutics, though necessarily short, appeal to the cultivator himself, and show that the book is designed to help him.

One fault of omission must be mentioned, if only in justice to those who have done good work in this country: the English literature is almost wholly ignored. We hesitate whether to blame the author—who only follows the too common practice of continental writers—or the editor for this. In any case the latter might have included references to Massee's and Somerville's experiments with *Plasmodiophora*, in his notes, to say nothing of other work by English botanists.

A feature in the work, which adds immensely to its value, is the selection of photographic illustrations of the diseased plants themselves, showing how the victims of fungus attacks look. This is as near an approach to taking the student into the field and showing him the disease at work, as can possibly be made in a book; and when we reflect that this—so to term it—clinical study is as important for plant diseases as it is in the case of human diseases, its importance is obvious. Few people are aware how

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much there is to be seen and learnt in the natural history of the diseases of forest and field and garden plants, and Tubeuf's examples should stimulate botanists to pay more attention to the subject. It is true the reproductions of the photographs are by means of the detestible "process blocks," which disfigure most of the books of the present age; but I suppose we must agree that the choice lies between these or none, as prices and means go.

It will be evident that the book is too large for even a brief review of more than the principal headings, but there are one or two features of importance which stand forth in salient contrast to anything met with in similar works.

These are signs of the times. One of the most striking is the far too meagre note on "selection of hardy varieties"—the word "hardy" does not accurately translate the original. From all sides we are now hearing that different varieties of vines, potatoes, wheat, &c., show different disease-resisting powers, and Tubeuf says, "An important method for the protection of plants from disease . . . consists in the selection and cultivation of varieties and species of plants able to resist the attacks of parasitic fungi."

The very brief account of what has been done with the vine, and the reference to what has been discovered about wheat, will only leave the reader hungry for more information.

In Erikssen and Henning's exhaustive volume on wheat-rust—to which I can discover no reference here, the author confining his remarks to a note they published last year in the *Zeitschrift f. Pflanzenkrankheiten*—the student will find that as matter of fact some varieties of wheat suffer little, and others much from *Puccinia*; and their extended investigations show that no mechanical theory as yet proposed explains this, but that a complex physiological phenomenon is here before us. They also show that the *Puccinia* of wheat-rust also varies, both morphologically and in its physiological relations to the disease. We have, in short, to face the fact that the culture of wheat-rust (for we do cultivate it), as well as the culture of cereals, result in the variation of both fungus and cereal, and it appears that selected varieties of both arise and are propagated.

Such varieties of parasitic fungi are also known in other groups—*e.g. Peridermium*, *Gymnosporangium*, *Ustilago*, &c.—and Tubeuf gives a short note under the respective heads; and we have several indications that physiological races are as common among parasitic fungi as they are among bacteria.

Clearly it is matter for experimental inquiry how far these variations are independent or concomitant, and it may be considered that one of the strongest reasons for encouraging the carrying out of agricultural experiments on a large scale, and the gathering of statistical results, that scientific men can urge, is the hope that more light will be thrown on the relations of these variations, and that we may succeed in utilising the knowledge in the practical evasion of disease. I remember being strongly impressed, in 1880–81, by the varietal differences between the *Hemileia* on coffee and that on *Canthium* in Ceylon, and even then threw out the hint that the former had been derived from the latter; but the comparative immunity of *Coffea Liberica* as contrasted with *C. Arabica*, suggested that it was not impossible that a disease-resisting coffee should be found.

The subject is complex, and bristles with difficulties; but that is no reason for hesitating as to the experimental inquiry; and indeed it has already been commenced in several countries, as the reports from Australia, America and elsewhere show.

Another feature of interest and importance in Von Tubeuf's book, is the chapter on "preventive and combative measures," involving the treatment of diseased plants by means of chemicals. Here, again, I notice a lack of attention to the English literature: Berkeley, and others of our countrymen, had experimented with sulphur in various forms, long before most of the authorities mentioned had taken the matter up. Still, it is quite true, the introduction of Bordeaux-mixture, and its employment on the enormous scales adopted in France, Australia, America and elsewhere, have taught us much, and suggested more. It is a common mistake to suppose that the intelligent application of remedial measures to plant-diseases does not pay—there are plenty of witnesses to the contrary; but, unfortunately, school and university courses generally have allowed of so little attention to the knowledge that must be utilised in carrying out such measures, that even skilled farmers, foresters, and other cultivators of plants, have to enter upon these experiments quite unequipped for carrying them out properly.

Tubeuf's chapter on the "economic importance of diseases of plants" may be cordially—if sadly—recommended to all who are interested in the very necessary extension of technical education by the institution of agricultural schools and colleges. He quotes the losses due to the Californian vine-disease (1892) at 10,000,000 dollars; in 1891 the wheat-rust cost Prussia over 20,000,000*l.*, and Australia something like 2,500,000*l.* Even allowing for large exaggerations—though reports from Sweden, India, Ceylon, the West Indies, and elsewhere suggest similarly large losses from fungus epidemics—in these estimates, it is evident that we have here to deal with annual losses of which even a saving of a very few pounds *per cent.* would be worth consideration; and the comparatively meagre experiments to hand hold out hopes of much more considerable saving, if steps are taken in time, with a due and intelligent knowledge of the problems to be faced, and the methods of facing them.

This must suffice for our review of this excellent book, the technical details of which are well treated, of the highest importance, and abounding with interest to the naturalist and botanist, as well as to the technologist and practical cultivator.

H. MARSHALL WARD.

CAPTAIN LYONS' REPORT ON THE ISLAND OF PHILÆ.

A Report on the Island and Temples of Philæ. By Captain H. G. Lyons, R.E.; with an Introductory Note by W. E. Garstin, C.M.G. (Printed by order of H.E. Hussein Fakhri Pasha, Minister of Public Works in Egypt, 1897.)

THE proposal to build a dam at Philæ, which was brought before the Egyptian Government a few years ago, at the instance of Mr. Willcocks, of the Irrigation Department of Egypt, will be fresh in the memory of many of our readers, even though the details of the

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